IEM's AI Modeling: Short-term COVID-19 Projections

Date: 10/18/21

Leveraging over 15 years of support to HHS for medical consequence modeling and our proprietary artificial intelligence (AI) models, IEM believes that our Coronavirus model outputs can be used to assist localities and their medical facilities to better prepare for an increase in hospitalizations, to better plan for and locate drive-through testing facilities, and to determine where increased levels of transmission may be occurring.

We have been refining our AI model over the past month and are confident in its ability to provide accurate 7-day projections that can be used for operational and logistical planning.

AI-based Model Background

IEM is currently using an AI model to fit data from various sources and project new cases of COVID-19. We do not assume the average number of secondary infections (R-value) stays the same over time. IEM's AI model finds the best R-value over time to evaluate how it changes over the course of the outbreak. The IEM modeling team is running ~11 million simulations to fit each state's data and using the best fit for the R-value to project new cases over the next 7 days. The AI models are executed on a daily basis to evaluate the changing dynamics of the COVID-19 pandemic. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 10/18/21 9 a.m.

Please provide any feedback or send any questions that you might have to us. We are continually updating and improving the model, so your feedback is critical.

Also, if you have more current or refined data for your State, Commonwealth or Territory that you would like IEM to factor in, please let us know.

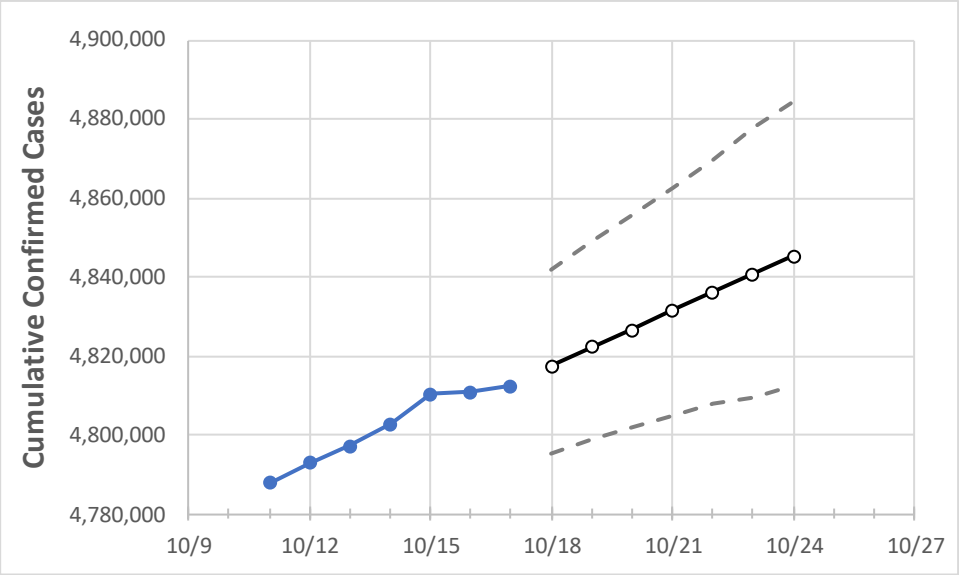
IEM's Modeling Lead

Dr. Prasith "Sid" Baccam is a **Computational Epidemiologist expert** at IEM with more than **20 years of experience in medical consequence modeling and simulation of disease outbreaks** and medical consequences following hypothetical attacks with biological agents or emerging infectious diseases. He develops key simulation models and decision support tools at IEM, specializing in public health, disaster response, and medical countermeasures (MCM) to enhance data-driven decision making and improve modeling assumptions.

Upon receiving his **Ph.D. in Applied Mathematics and Immunobiology** at Iowa State University, Dr. Baccam worked as a Postdoctoral Research Associate at Los Alamos National Laboratory where he focused on researching viral and immunological modeling. After his stint at Los Alamos, Dr. Baccam has served as Task Lead in multiple public health projects have allowed him to develop expertise as a mathematical biologist and a leader on high-performance modeling and simulation teams.

He has worked with state and local public health officials as well as Federal agencies, including **HHS**, the Centers for Disease Control and Prevention (**CDC**), and the Department of Homeland Security (**DHS**). Dr. Baccam has published numerous papers on public health response models and implications on policy and has been invited to participate in workshops and symposiums held by the Institute of Medicine (now the National Academy of Health). His modeling results have been briefed to the **Executive Office of the President** and informed two presidential policy actions.

California State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	10/14	10/15	10/16	10/17	10/18	10/19	10/20	10/21	10/22	10/23	10/24
California	4,802,761	4,810,222	4,810,682	4,812,309	4,817,329	4,822,308	4,826,382	4,831,637	4,836,068	4,840,769	4,845,177

Note: The State's projection shows a "best estimate" curve (the solid line with circles) and the dotted lines are the upper and lower estimates around that best estimate. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

California Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	10/14	10/15	10/16	10/17	10/18	10/19	10/20	10/21	10/22	10/23	10/24
Alameda	119,774	119,887	119,887	119,887	120,006	120,125	120,242	120,356	120,474	120,593	120,706
Contra Costa	99,102	99,234	99,234	99,234	99,349	99,463	99,583	99,697	99,808	99,922	100,038
Fresno	143,745	144,123	144,123	144,123	144,451	144,781	145,097	145,430	145,749	146,072	146,411
Kern	143,716	144,146	144,146	144,146	144,498	144,848	145,202	145,550	145,907	146,269	146,626
Lake	6,499	6,506	6,506	6,506	6,521	6,534	6,548	6,562	6,576	6,590	6,602
Los Angeles	1,474,552	1,475,694	1,476,243	1,476,791	1,477,647	1,478,501	1,479,323	1,480,150	1,480,953	1,481,745	1,482,550
Marin	17,570	17,581	17,581	17,581	17,595	17,609	17,622	17,636	17,649	17,663	17,676
Monterey	50,676	50,696	50,696	50,696	50,729	50,758	50,788	50,820	50,846	50,876	50,903
Orange	322,497	322,741	322,741	322,741	322,931	323,117	323,298	323,485	323,663	323,830	324,004
Placer	38,813	38,902	38,902	38,902	38,986	39,063	39,143	39,222	39,300	39,386	39,461
Riverside	368,953	369,344	369,344	369,344	369,658	369,963	370,267	370,561	370,865	371,154	371,432
Sacramento	157,498	157,621	157,621	157,621	157,874	158,129	158,380	158,631	158,881	159,136	159,384
San Bernardino	355,848	356,315	356,315	356,315	356,595	356,857	357,114	357,377	357,638	357,889	358,142
San Diego	363,169	363,644	364,104	364,634	365,051	365,472	365,890	366,304	366,708	367,097	367,507
San Francisco	53,974	54,031	54,031	54,031	54,104	54,177	54,247	54,322	54,395	54,467	54,539
San Joaquin	101,643	101,807	101,807	101,807	101,940	102,063	102,191	102,313	102,433	102,562	102,684
San Luis Obispo	29,590	29,653	29,653	29,653	29,685	29,721	29,752	29,785	29,816	29,850	29,880
San Mateo	53,781	53,828	53,828	53,828	53,874	53,919	53,964	54,007	54,051	54,096	54,140
Santa Barbara	44,770	44,836	44,836	44,836	44,893	44,947	45,004	45,057	45,116	45,170	45,228
Santa Clara	144,300	144,518	144,518	144,518	144,667	144,816	144,957	145,103	145,247	145,397	145,544
Santa Cruz	20,830	20,861	20,861	20,861	20,883	20,904	20,925	20,945	20,966	20,987	21,005
Solano	45,734	45,761	45,761	45,761	45,806	45,849	45,891	45,932	45,973	46,014	46,052
Sonoma	40,638	40,711	40,711	40,711	40,761	40,814	40,864	40,917	40,968	41,022	41,074
Ventura	100,442	100,524	100,524	100,524	100,623	100,718	100,814	100,909	101,002	101,100	101,201

Some recipients of our daily COVID-19 short-term (7 day) projections have requested projections of demand for: hospital bed, intensive care unit (ICU) beds, and mechanical ventilation. We realize that different states and localities will have different characteristics for hospital demand of COVID-19 cases, and we are presenting the best assumptions we could find for those medical demands based on scientific literature and health data reporting. Specifically:

- *Beds: For hospitalization, we use a range of 10% and 20% of cases require hospitalization based on CDC's report (MMWR, March 18, 2020) and state reports of COVID-19 cases.*
- *ICU: The CDC report found that 24% of hospitalized cases require ICU care.*
- *Ventilators: Based on clinical data from China and state reports, we assume that 50% of ICU cases require a ventilator.*

If you have other estimates for these assumptions, please share them with us as we work to refine our modeling, assumptions, and data on a daily basis.

*The medical demands shown in the table assume 20% of **cumulative** confirmed cases require hospitalization. To get the medical demand for the assumption that 10% of confirmed cases require hospitalization, simply divide the demand by 2.*

California Medical Demand by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:		
	10/14	10/15	10/16	10/17	10/19	10/21	10/23
Alameda	119,774	119,887	119,887	119,887	120,125 (24,025) [5,766] {2,883}	120,356 (24,071) [5,777] {2,889}	120,593 (24,119) [5,788] {2,894}
Contra Costa	99,102	99,234	99,234	99,234	99,463 (19,893) [4,774] {2,387}	99,697 (19,939) [4,785] {2,393}	99,922 (19,984) [4,796] {2,398}
Fresno	143,745	144,123	144,123	144,123	144,781 (28,956) [6,949] {3,475}	145,430 (29,086) [6,981] {3,490}	146,072 (29,214) [7,011] {3,506}
Kern	143,716	144,146	144,146	144,146	144,848 (28,970) [6,953] {3,476}	145,550 (29,110) [6,986] {3,493}	146,269 (29,254) [7,021] {3,510}
Lake	6,499	6,506	6,506	6,506	6,534 (1,307) [314] {157}	6,562 (1,312) [315] {157}	6,590 (1,318) [316] {158}
Los Angeles	1,474,552	1,475,694	1,476,243	1,476,791	1,478,501 (295,700) [70,968] {35,484}	1,480,150 (296,030) [71,047] {35,524}	1,481,745 (296,349) [71,124] {35,562}
Marin	17,570	17,581	17,581	17,581	17,609 (3,522) [845] {423}	17,636 (3,527) [847] {423}	17,663 (3,533) [848] {424}
Monterey	50,676	50,696	50,696	50,696	50,758 (10,152) [2,436] {1,218}	50,820 (10,164) [2,439] {1,220}	50,876 (10,175) [2,442] {1,221}
Orange	322,497	322,741	322,741	322,741	323,117 (64,623) [15,510] {7,755}	323,485 (64,697) [15,527] {7,764}	323,830 (64,766) [15,544] {7,772}
Placer	38,813	38,902	38,902	38,902	39,063 (7,813) [1,875] {938}	39,222 (7,844) [1,883] {941}	39,386 (7,877) [1,891] {945}
Riverside	368,953	369,344	369,344	369,344	369,963 (73,993) [17,758] {8,879}	370,561 (74,112) [17,787] {8,893}	371,154 (74,231) [17,815] {8,908}
Sacramento	157,498	157,621	157,621	157,621	158,129 (31,626) [7,590] {3,795}	158,631 (31,726) [7,614] {3,807}	159,136 (31,827) [7,639] {3,819}
San Bernardino	355,848	356,315	356,315	356,315	356,857 (71,371) [17,129] {8,565}	357,377 (71,475) [17,154] {8,577}	357,889 (71,578) [17,179] {8,589}
San Diego	363,169	363,644	364,104	364,634	365,472 (73,094) [17,543] {8,771}	366,304 (73,261) [17,583] {8,791}	367,097 (73,419) [17,621] {8,810}
San Francisco	53,974	54,031	54,031	54,031	54,177 (10,835) [2,601] {1,300}	54,322 (10,864) [2,607] {1,304}	54,467 (10,893) [2,614] {1,307}
San Joaquin	101,643	101,807	101,807	101,807	102,063 (20,413) [4,899] {2,450}	102,313 (20,463) [4,911] {2,456}	102,562 (20,512) [4,923] {2,461}
San Luis Obispo	29,590	29,653	29,653	29,653	29,721 (5,944) [1,427] {713}	29,785 (5,957) [1,430] {715}	29,850 (5,970) [1,433] {716}
San Mateo	53,781	53,828	53,828	53,828	53,919 (10,784) [2,588] {1,294}	54,007 (10,801) [2,592] {1,296}	54,096 (10,819) [2,597] {1,298}
Santa Barbara	44,770	44,836	44,836	44,836	44,947 (8,989) [2,157] {1,079}	45,057 (9,011) [2,163] {1,081}	45,170 (9,034) [2,168] {1,084}
Santa Clara	144,300	144,518	144,518	144,518	144,816 (28,963) [6,951] {3,476}	145,103 (29,021) [6,965] {3,482}	145,397 (29,079) [6,979] {3,490}
Santa Cruz	20,830	20,861	20,861	20,861	20,904 (4,181) [1,003] {502}	20,945 (4,189) [1,005] {503}	20,987 (4,197) [1,007] {504}
Solano	45,734	45,761	45,761	45,761	45,849 (9,170) [2,201] {1,100}	45,932 (9,186) [2,205] {1,102}	46,014 (9,203) [2,209] {1,104}
Sonoma	40,638	40,711	40,711	40,711	40,814 (8,163) [1,959] {980}	40,917 (8,183) [1,964] {982}	41,022 (8,204) [1,969] {985}
Ventura	100,442	100,524	100,524	100,524	100,718 (20,144) [4,834] {2,417}	100,909 (20,182) [4,844] {2,422}	101,100 (20,220) [4,853] {2,426}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at bryan.koon@iem.com or 850-519-7966 or Stephanie Tennyson at stephanie.tennyson@iem.com or 202-309-4257.